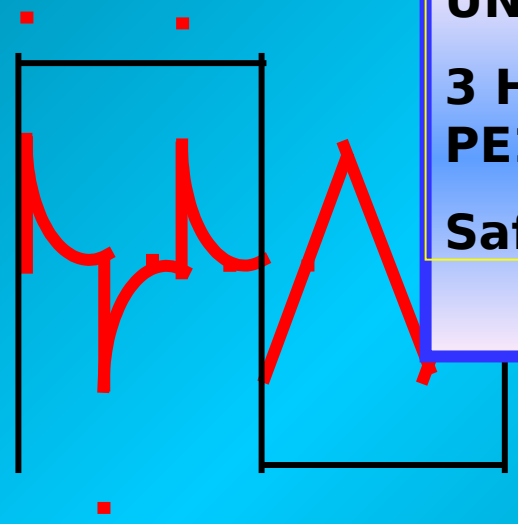
AC:

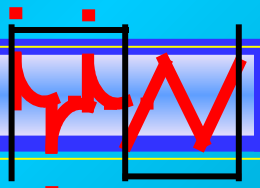
Transients in LR Circuits



UNCLASSIFIED:

3 Hour Conference W/1 Hr PE3 & 3 Hr PE1

Safety & Environmental Impact: LOW



Terminal Learning Objective

ACTION;

Given an LR Ckt, calculate for Time Constant, Pulse-Width and TC PW ratio.

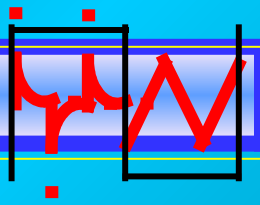
Identify the type of Ckt given the output waveform.

CONDITIONS;

With Official { White } OMEMS Training Aid.

STANDARD;

A minimum 7 correct of 10 questions.



Introduction

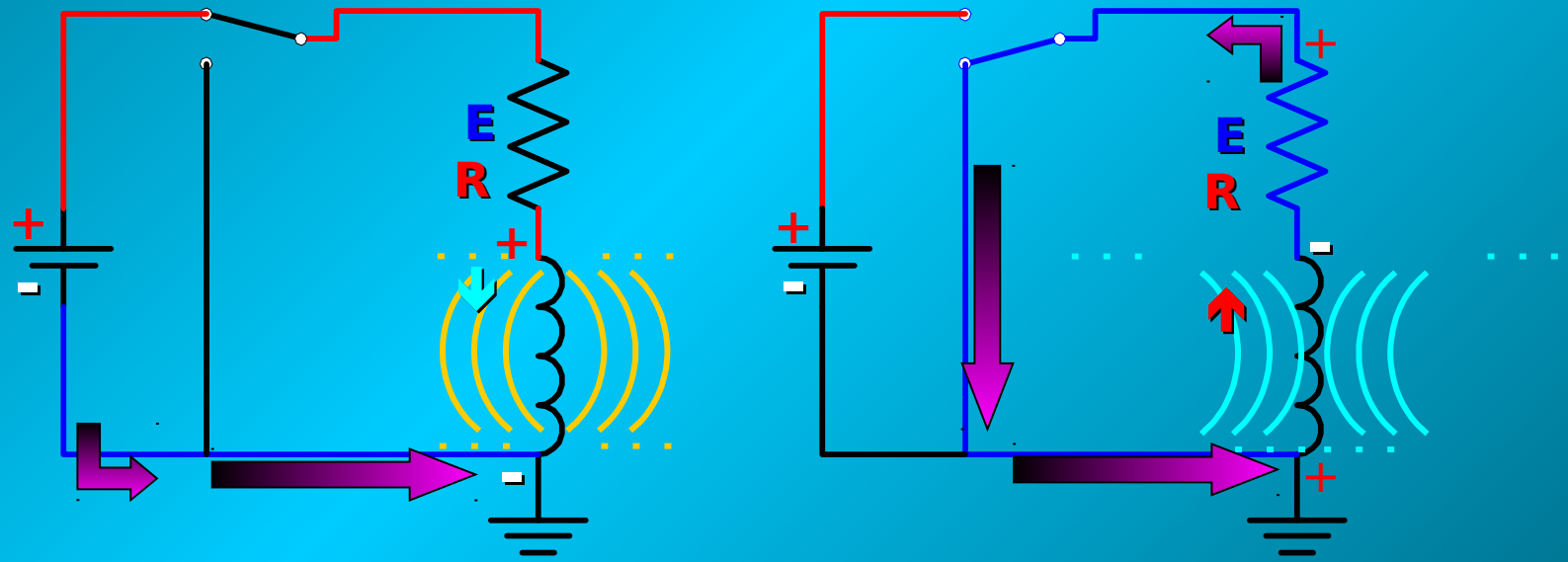
This lesson will enable you to determine what type of ckt is being used based upon the size of the Resistor & Inductor which will change the input waveform to a distinctly different waveform at the output.

The circuits are used extensively in private & defense electronics for timing devices.

AC: Transients in LR Circuits

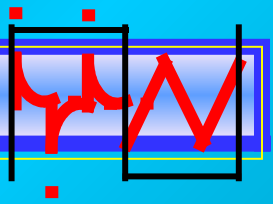
LR Ckt;

A Ckt comprised of a Resistor & Inductor in series, where the rate [time] of Expansion & Contraction is dictated by the value [size] of the Resistor & Inductor.



TC

AC: Transients in LR Circuits



TC;

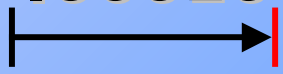
TC = Time for current to reach approximately 63% of maximum expansion.

TC = L/R

L = 10 mh **R = 100 Ω**

10 EE $^{-3}$ ÷ 100 = .0001 Sec = 100 μS

Move the decimal 6 places .000100.



or On the calculator; 2nd Function 6 ⇒ 100^{-6}

In μSec only

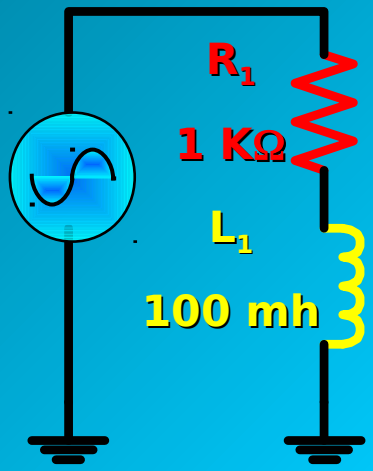
Reference White Gov Tng Aid.

AC: Transients in LR Circuits

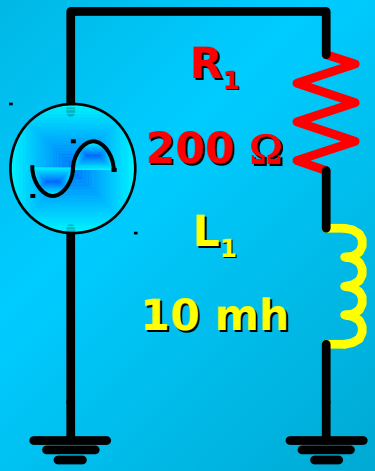
TC; Calculate the TC for the following Ckts.

$$TC = L/R$$

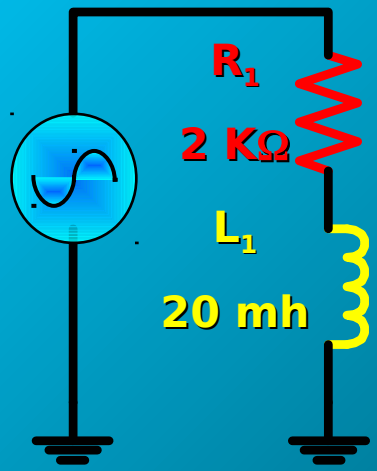
In μSec only



TC =_____



TC =_____



TC =_____

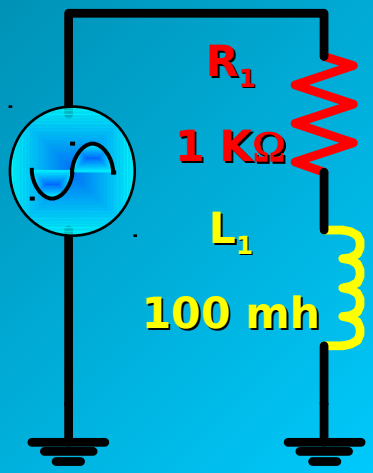
Answers

AC: Transients in LR Circuits

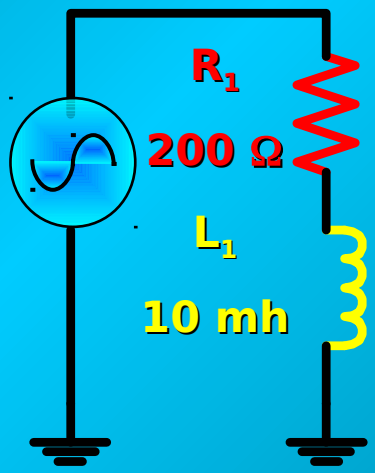
TC; Calculate the TC for the following Ckts.

$$TC = L/R$$

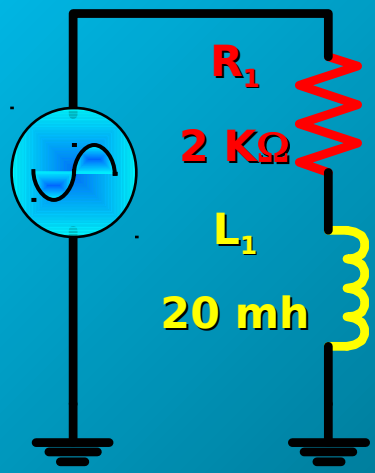
In μSec only



TC = 100 μS



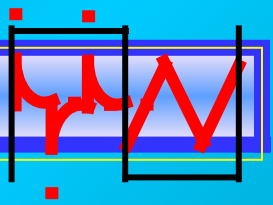
TC = 50 μS



TC = 10 μS

PW

AC: Transients in LR Circuits



Pulse Width;

PW In **μSec** only **= 2 X Freq 1/X**

$$PW = \frac{1}{2F} \qquad PW = \frac{1}{2 \times Freq}$$

On the Calculator; Frequency = 10 KHz

10 EE³ X 2 = 1/X ⇒ .00005 Sec

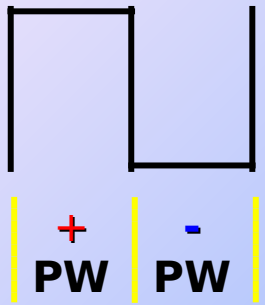
PW = .0000 50. μS

W/ 2nd Function Key; **PW = 50^{-6}**

PW Must be in **μS**

AC: Transients in LR Circuits

Pulse Width; Calculate PW = 2X Freq 1/X



5 KHz PW = _____

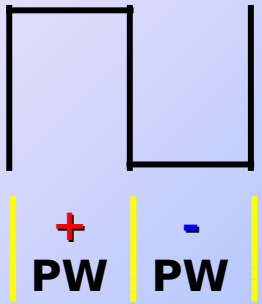
1 KHz PW = _____

20 KHz PW = _____

Answers

AC: Transients in LR Circuits

Pulse Width; PW = 2X Freq 1/X

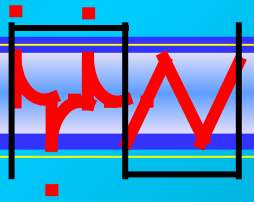


5 KHz PW = 100 μS

1 KHz PW = 500 μS

20 KHz PW = 25 μS

AC: Transients in LR Circuits



TC to PW Ratio;

time is

expand to

$$\frac{\text{TC = Time}}{\text{Needed}}$$

$$\frac{\text{PW = Time}}{\text{Have}}$$

The TC tells us how much NEEDED for the fields to 63% of maximum.

The PW tell us how much time we HAVE for the fields to expand to 63% of maximum.

Reduce the Fraction; $\frac{TC}{PW} = \frac{10\ \mu S}{100\ \mu S} \Rightarrow \frac{10}{100} \Rightarrow \frac{1}{10}$

Strike out the common 0

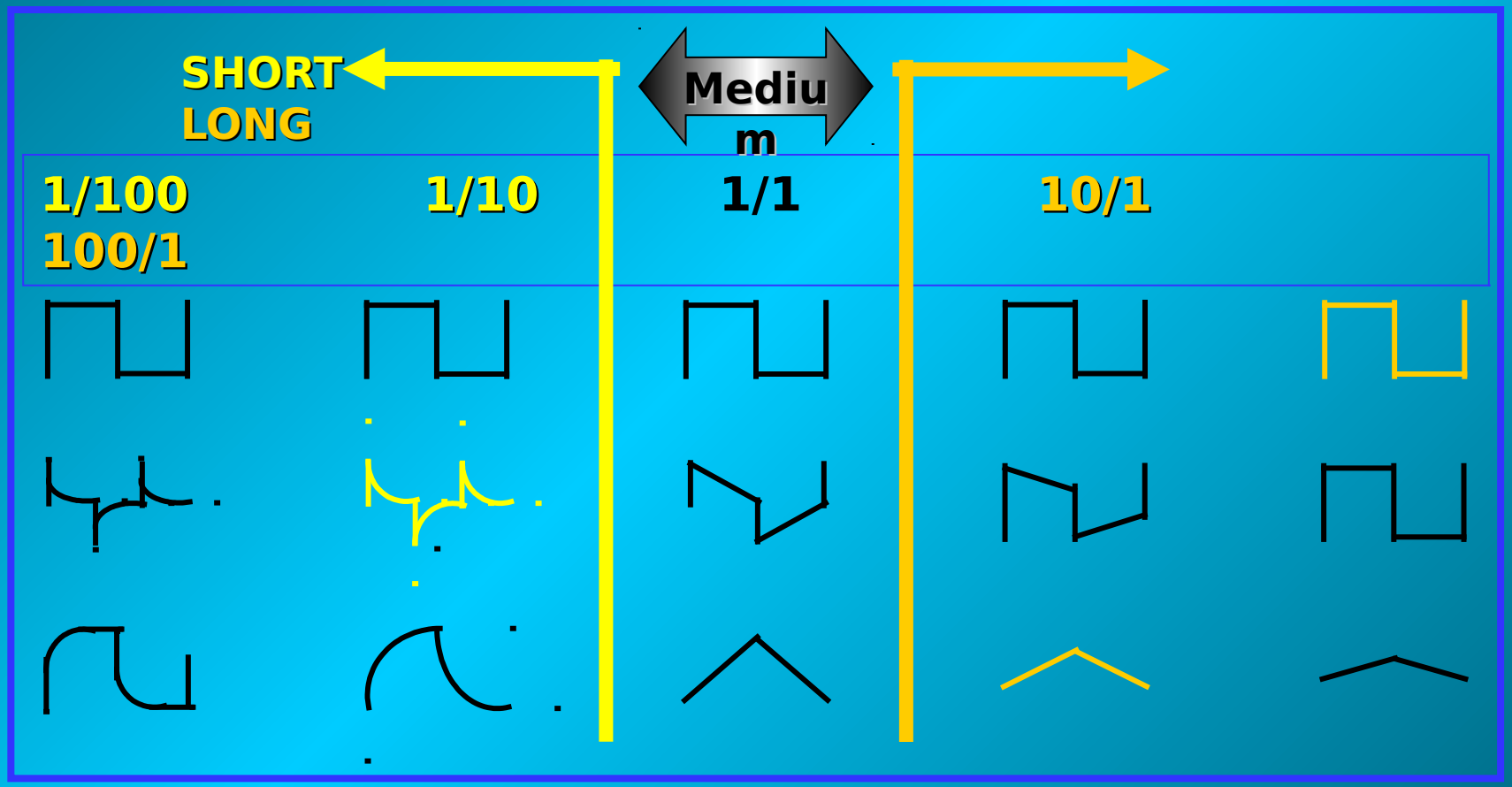
Note;

All fractions must be reduced to the lowest term of 1/# or #/1

TC/ PW Chart

AC: Transients in LR Circuits

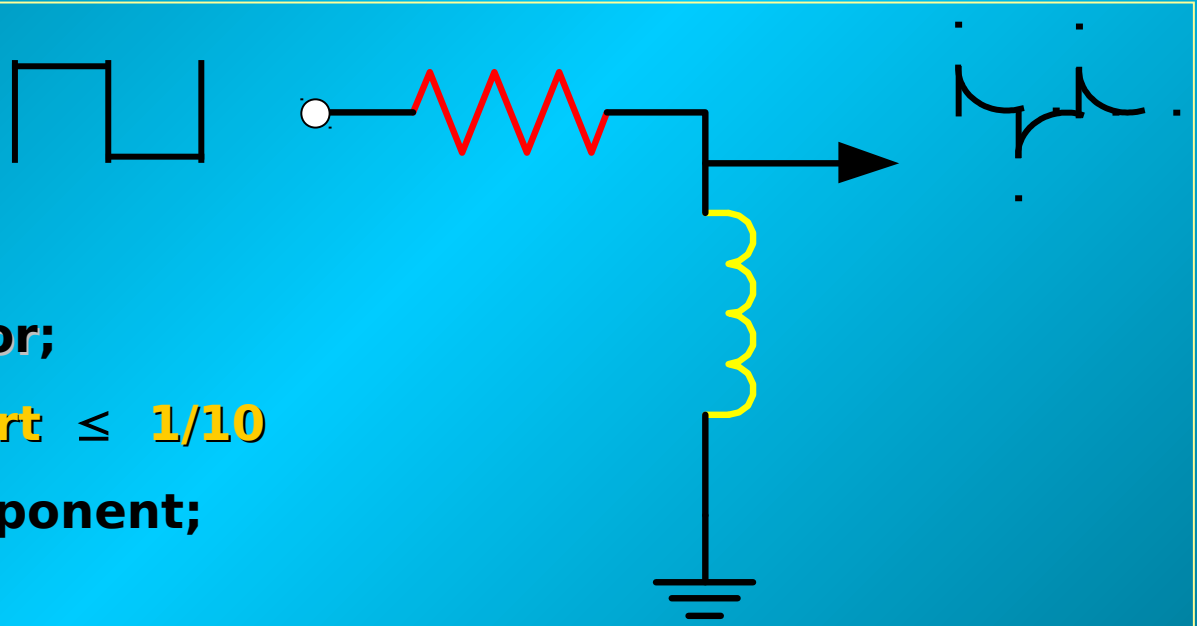
TC to PW Ratio; Chart



Differentiator

AC: Transients in LR Circuits

Ckt Types; Differentiator.



Differentiator;

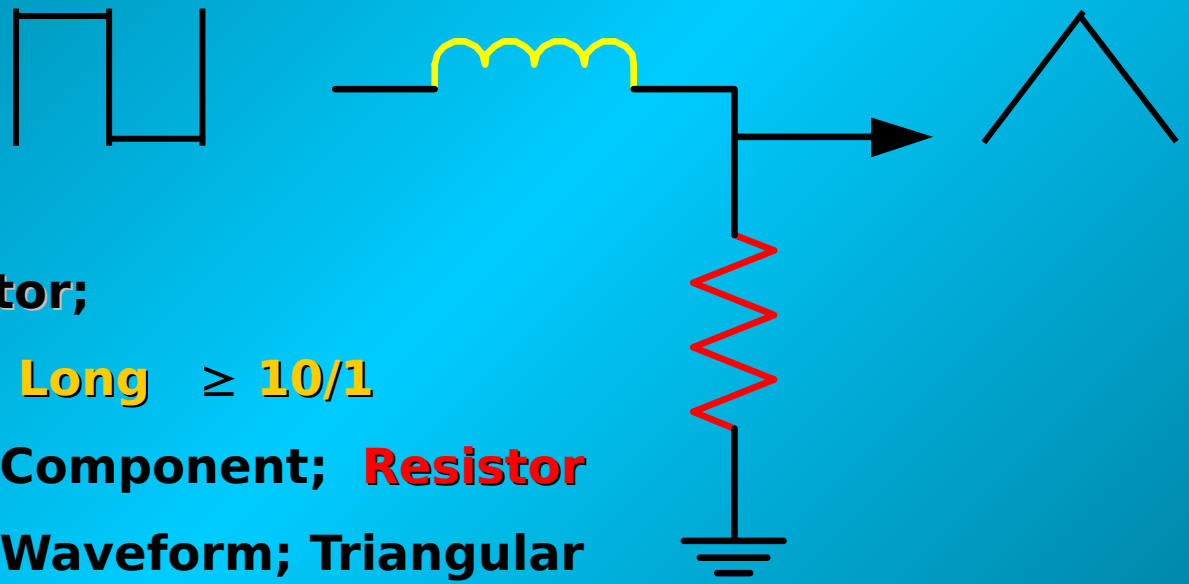
TC/PW; Short ≤ 1/10

Output Component; Inductor

Output Waveform; Spiked

AC: Transients in LR Circuits

Ckt Types; Integrator.



Integrator;

TC/PW; Long ≥ 10/1

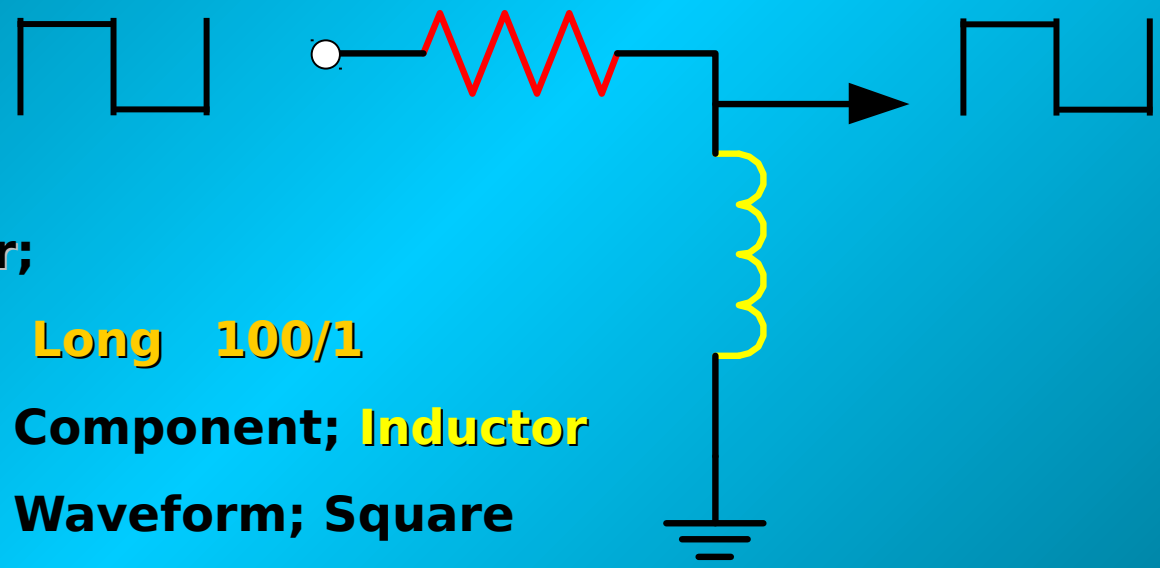
Output Component; Resistor

Output Waveform; Triangular

Coupler

AC: Transients in LR Circuits

Ckt Types; Coupler.



Coupler;

TC/PW; Long 100/1

Output Component; Inductor

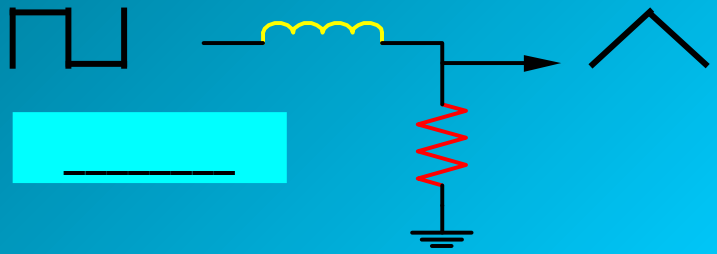
Output Waveform; Square

Reference White Gov Tng

AC: Transients in LR Circuits

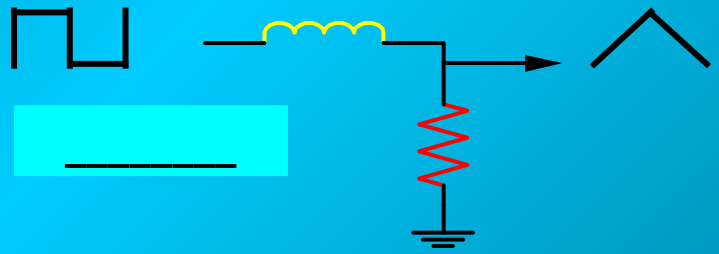
JOB 1; **ID the Ckts as a Differentiator, Integrator, Coupler.**

a.



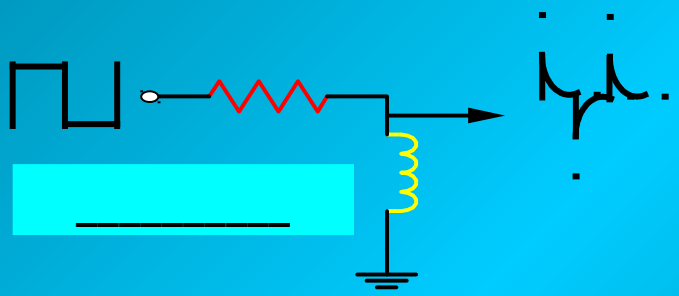
_____

d.



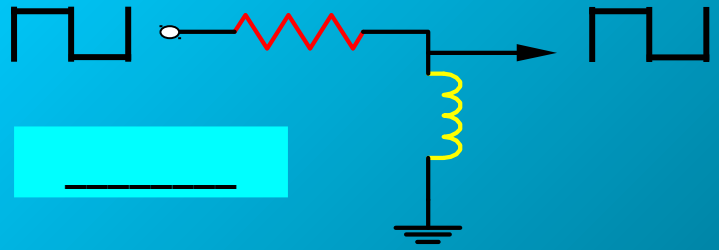
_____

b.



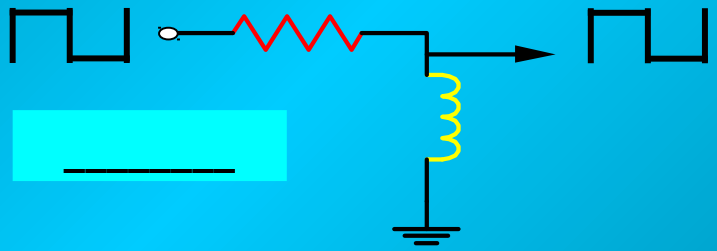
_____

e.



_____

c.



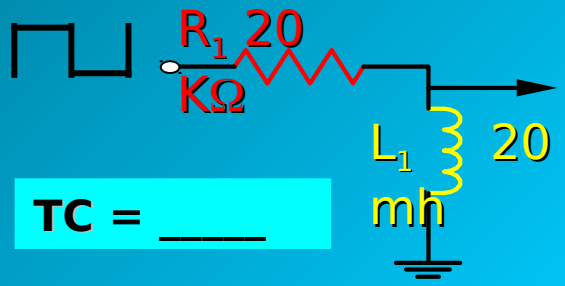
_____

Job 1 : Answers

AC: Transients in LR Circuits

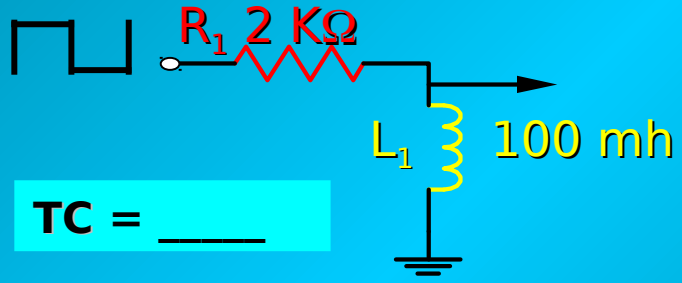
JOB 2; **Calculate the TC of the following LR Ckts.**

a.



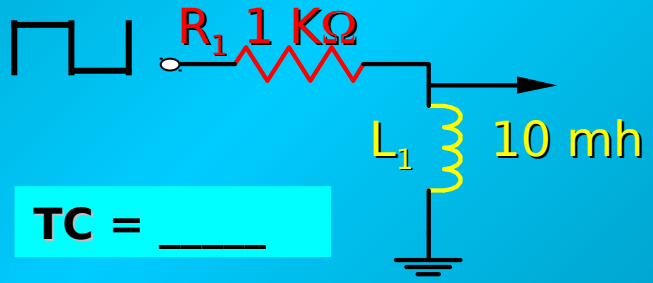
TC = _____

b.



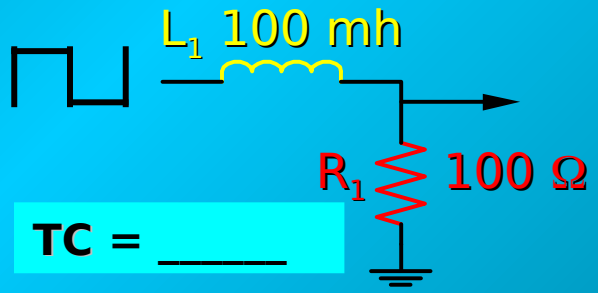
TC = _____

c.



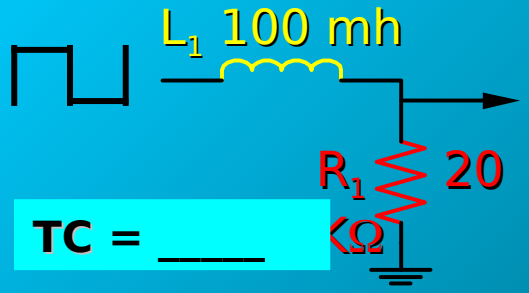
TC = _____

d.



TC = _____

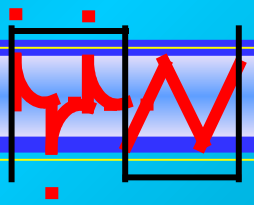
e.



TC = _____

Job 2 : Answers

AC: Transients in LR Circuits



JOB 3; Calculate the PW of the following Frequencies.

a. Freq = 5 KHz PW = _____

b. Freq = 100 Hz PW = _____

c. Freq = 15 KHz PW = _____

d. Freq = 25 KHz PW = _____

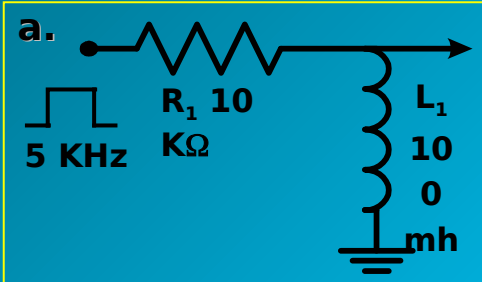
e. Freq = 100 KHz PW = _____

Job 3 : Answers

AC: Transients in LR Circuits

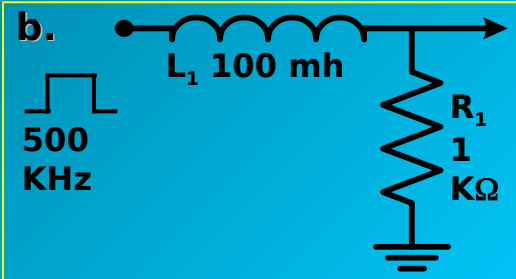
JOB 4; Calculate the TC /PW Ratio of the following LR Ckts.

a.



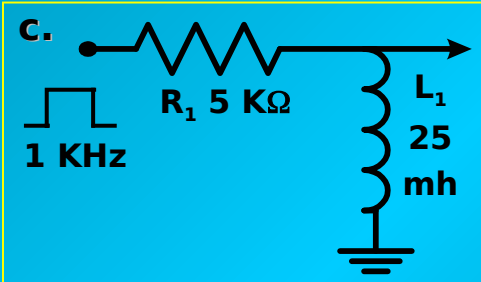
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

b.



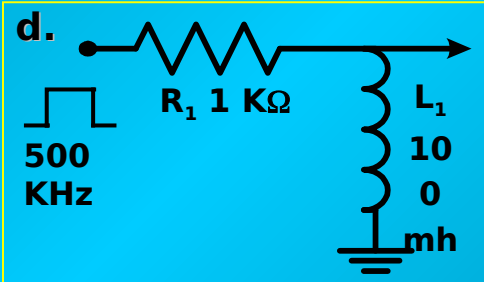
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

c.



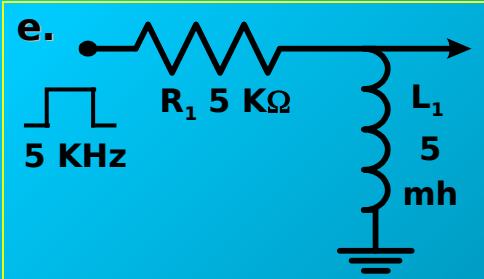
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

d.



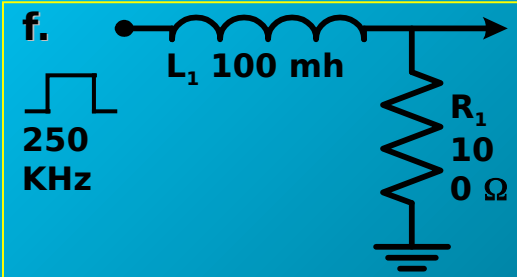
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

e.



TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

f.



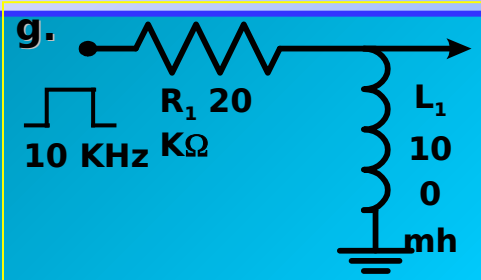
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

Answers a-f

AC: Transients in LR Circuits

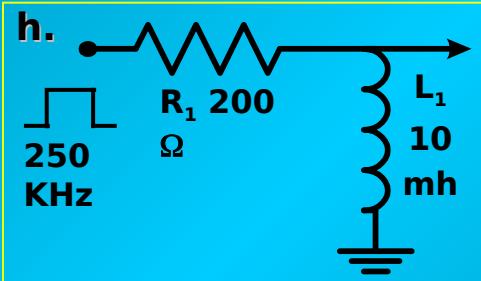
JOB 4 cont. ; Calculate the TC /PW Ratio of the following LR Ckts.

g.



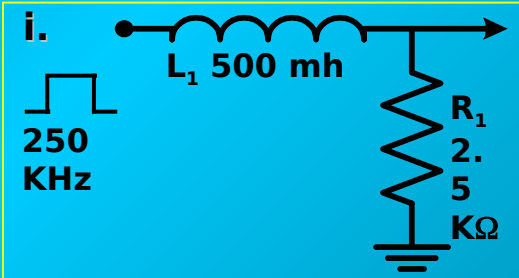
TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

h.



TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

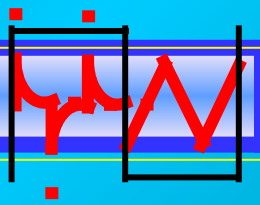
i.



TC = _____
PW = _____
Ratio = _____
Name; _____
TC/PW = _____

Answers g-i

AC: Transients in LR Circuits



SUMMARY & QUESTIONS;

LESSON TEST;

Time; **20 Minutes.**

References; **Official OMEMS Training Aids.**

Standard; **7 of 10 answered correctly.**